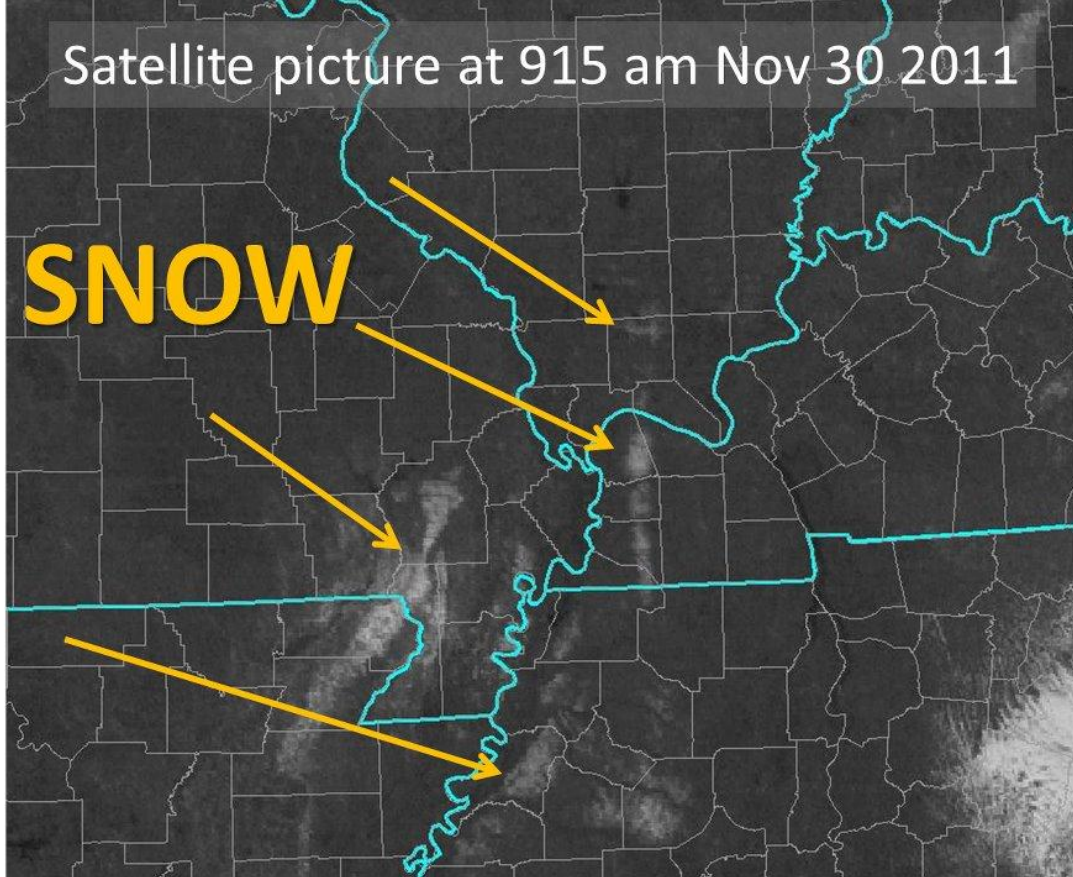


Satellite picture at 915 am Nov 30 2011

SNOW



Anticipating Banded Snowfall

A review of the 11/29/11 Mesoscale Thundersnow Event

Pat Spoden – SOO NWS Paducah, KY (Fall 2012)



Work Already Done

- Science Team looked at 4 cases from the winter of 2010-2011
- Main Findings:
 - Banded snowfall increased expected snowfall amounts
 - Forecasters can anticipate the formation of snow bands
- This particular case is almost impossible to forecast more than an hour or two in advance, it is more of a reactionary forecast
- Both the NAM and the GFS had some hints, but the GFS was farther west with its forecast.



Anticipating Snow Bands - Findings

- **What to look for**

- **850-700 mb Frontogenesis**

Why

provides baroclinic environment/lift

- **500-300 mb Div Q**

focused lift areas w/Jet

- **Neg EPV – located in the 400-600 mb layer**

Stratospheric Intrusion/ Instability. A parcel with negative EPV is convectively unstable.

- **Backing of 700 mb Theta-e**

TROWAL Identification - areas where banding is possible

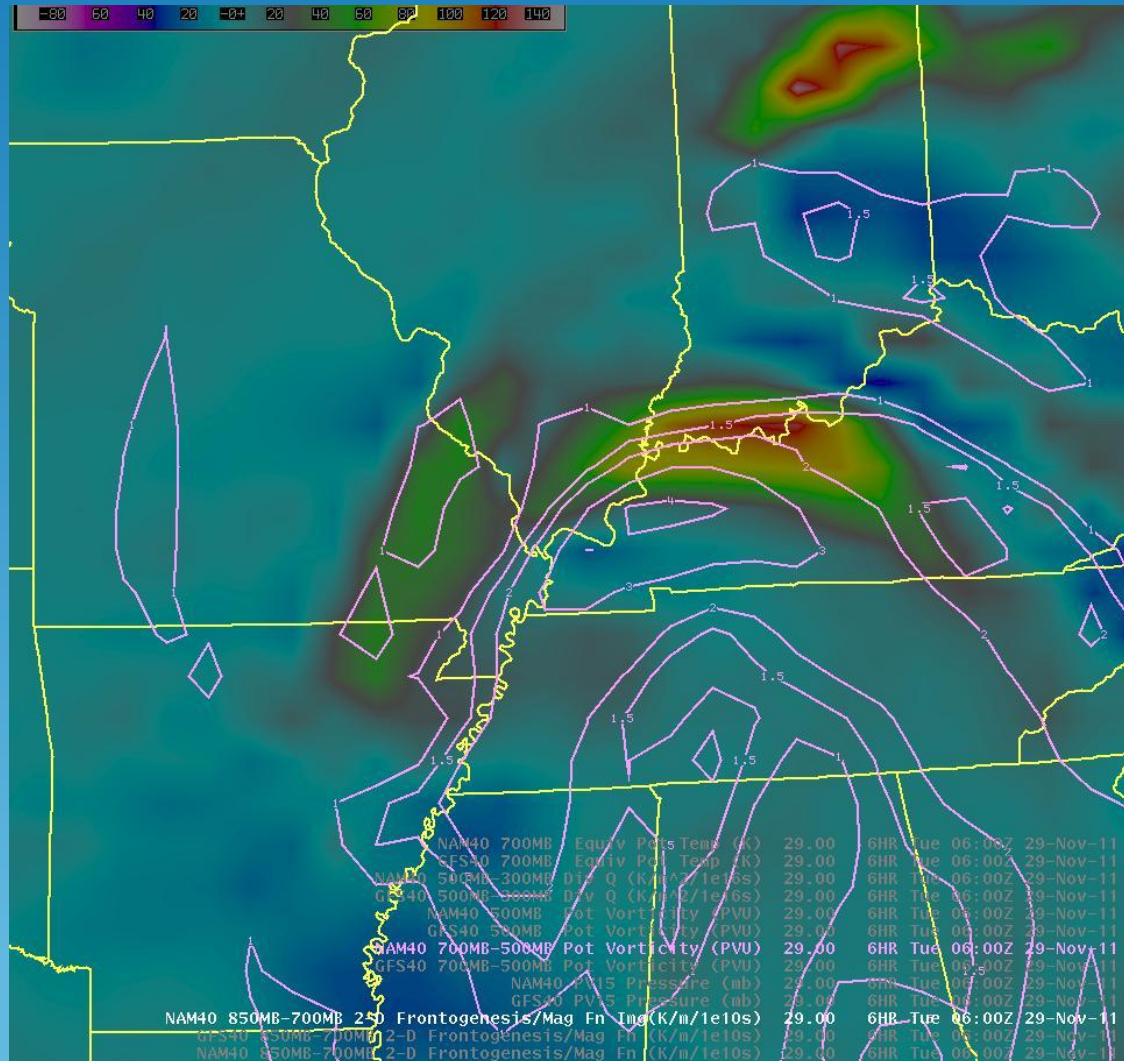
- **Look for soundings with adiabatic/moist adiabatic lapse rates just below the dendritic crystal growth zone ($\sim -12^{\circ}\text{C}$)**

How much lift available

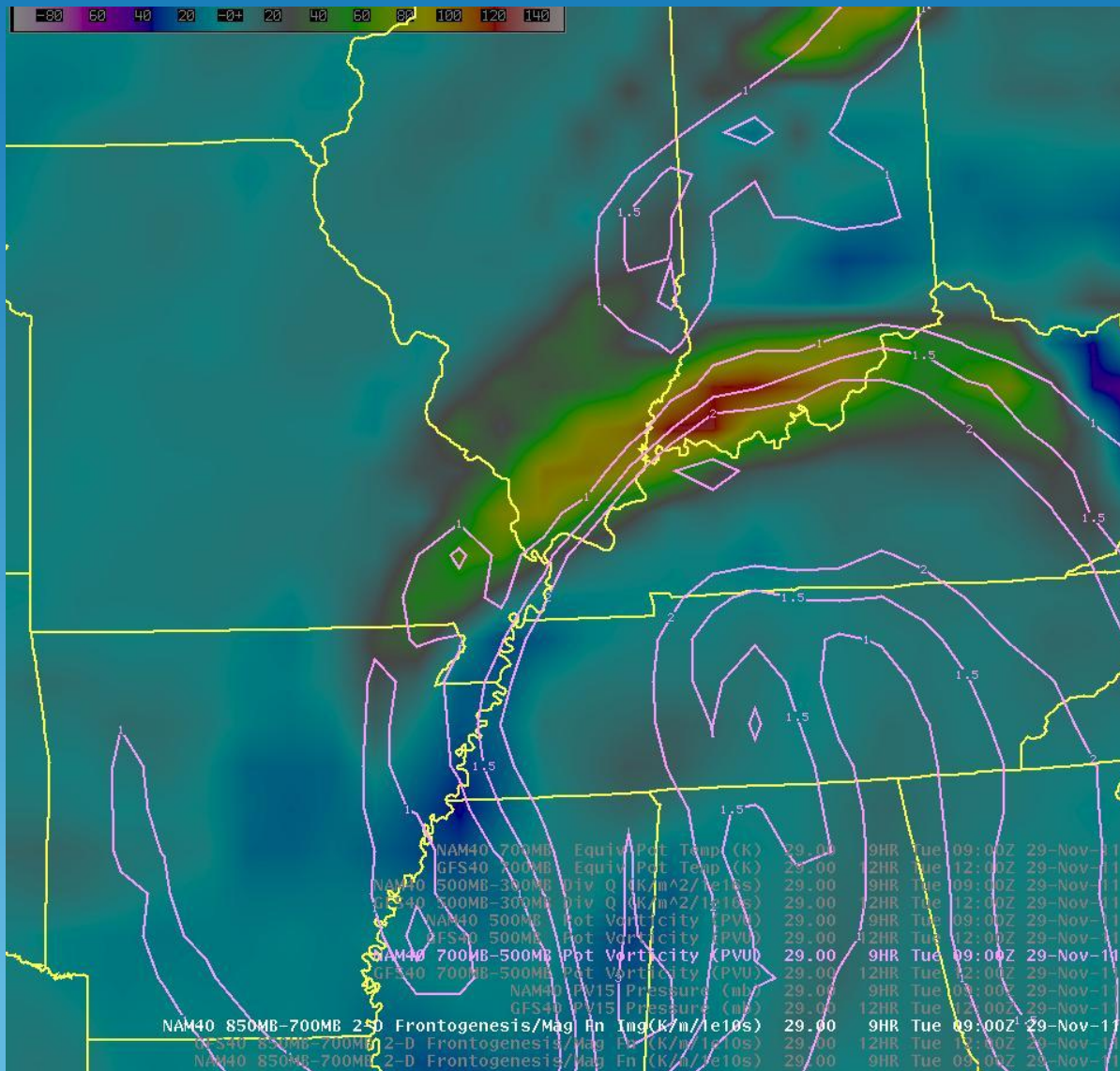




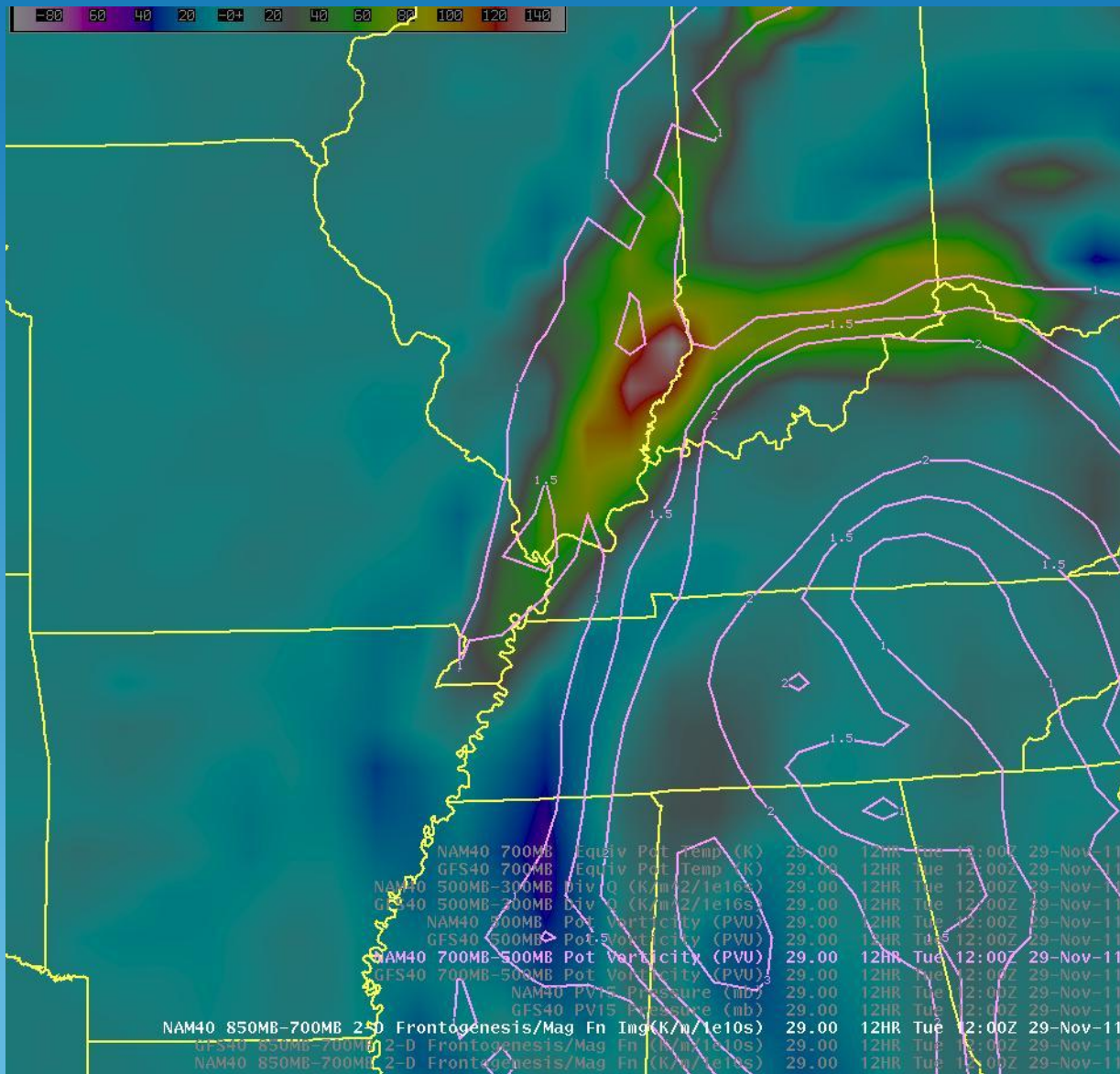
Frontogenesis and PV – 06Z (Midnight)



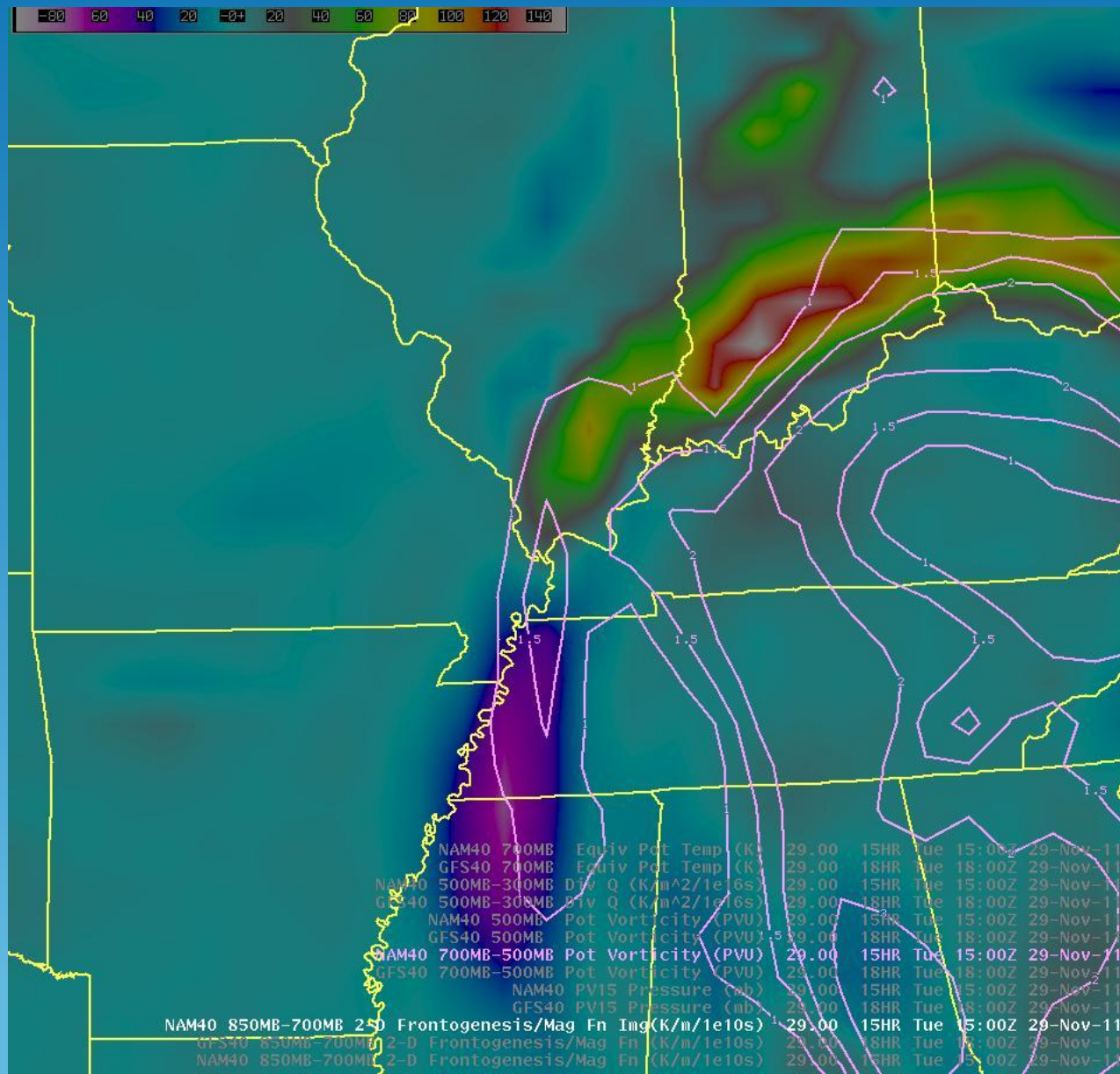
Frontogenesis and PV – 09Z (3AM)



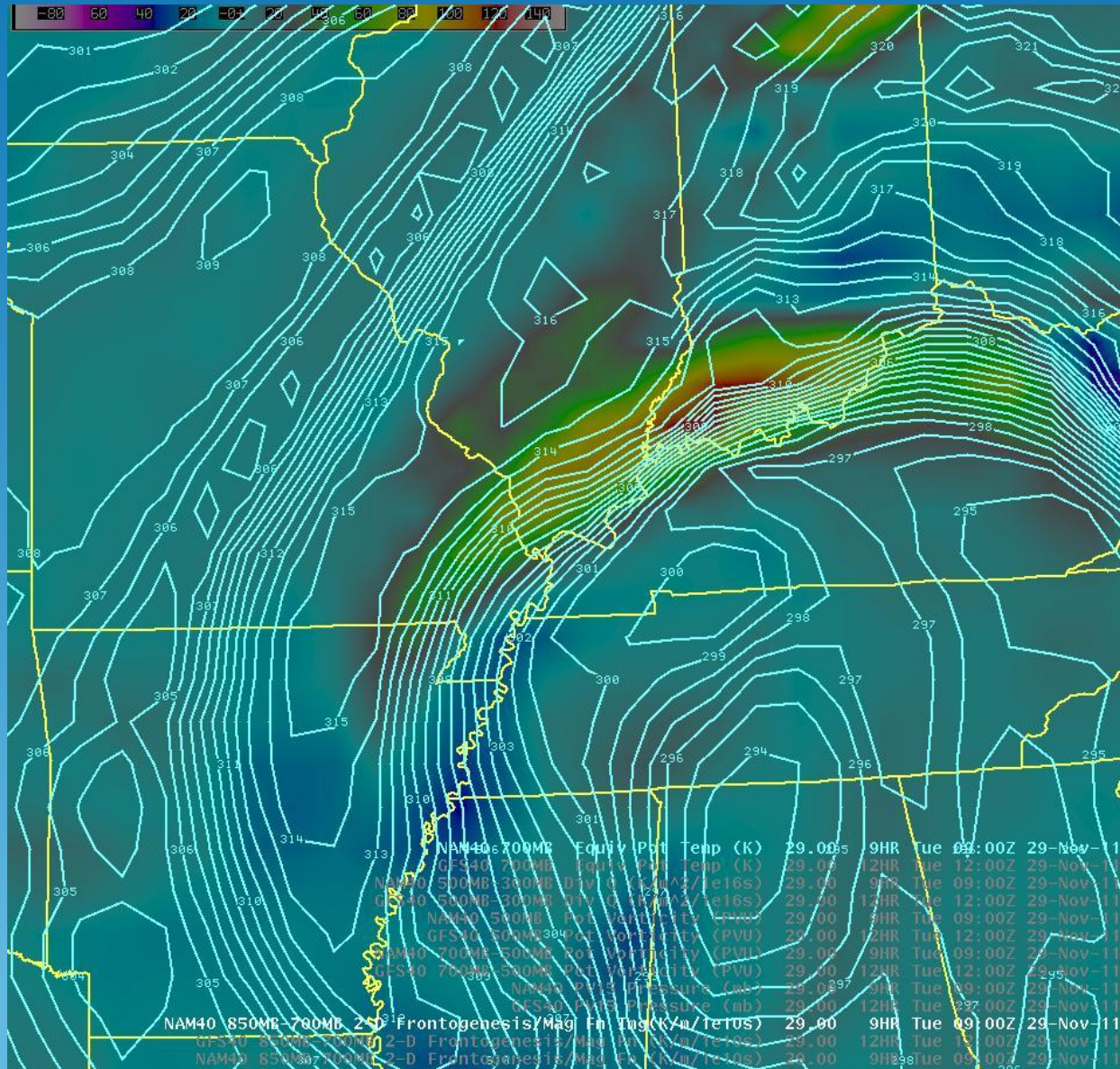
Frontogenesis and PV – 12Z (6AM)



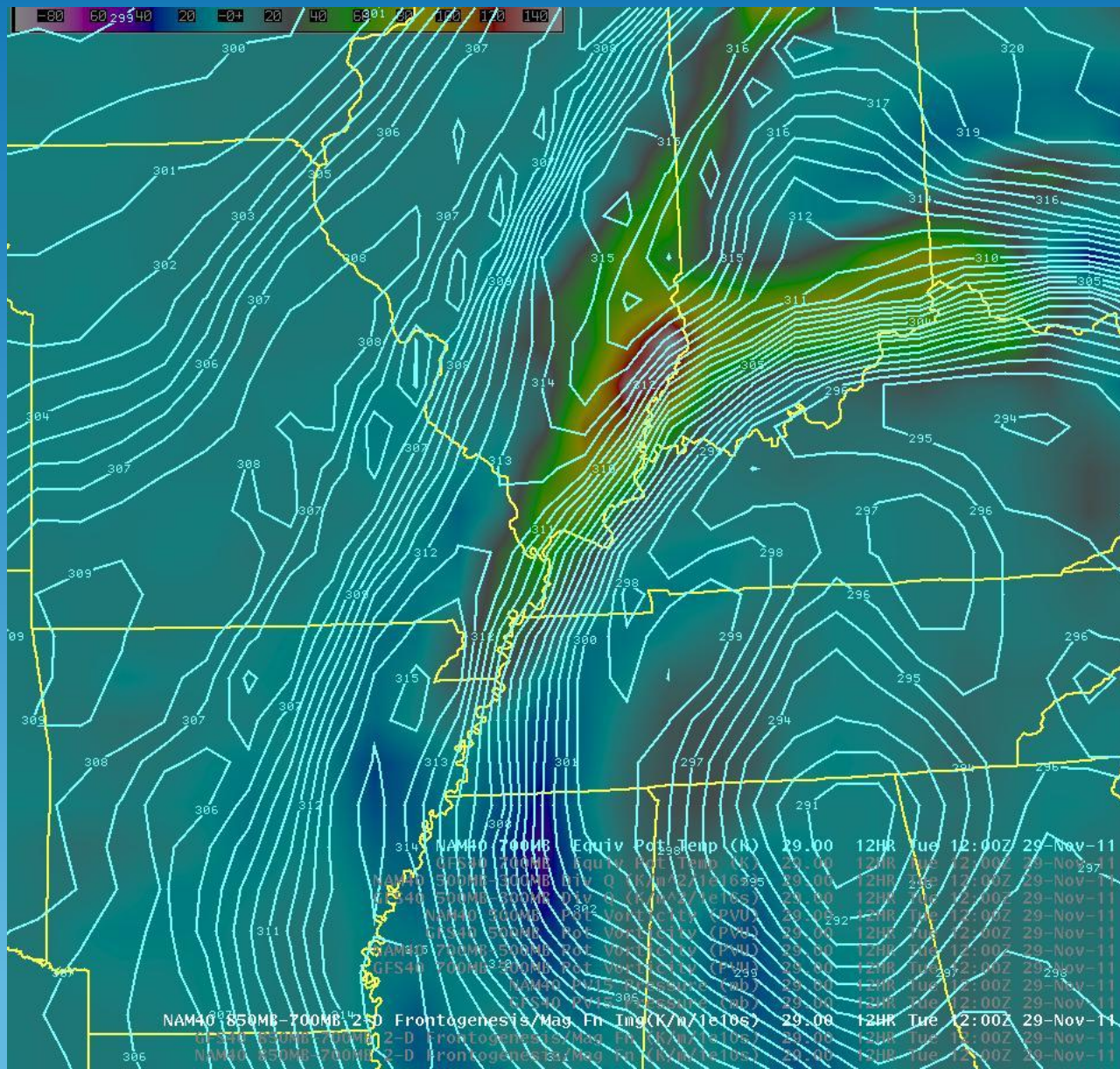
Frontogenesis and EPV – 15Z (9AM)



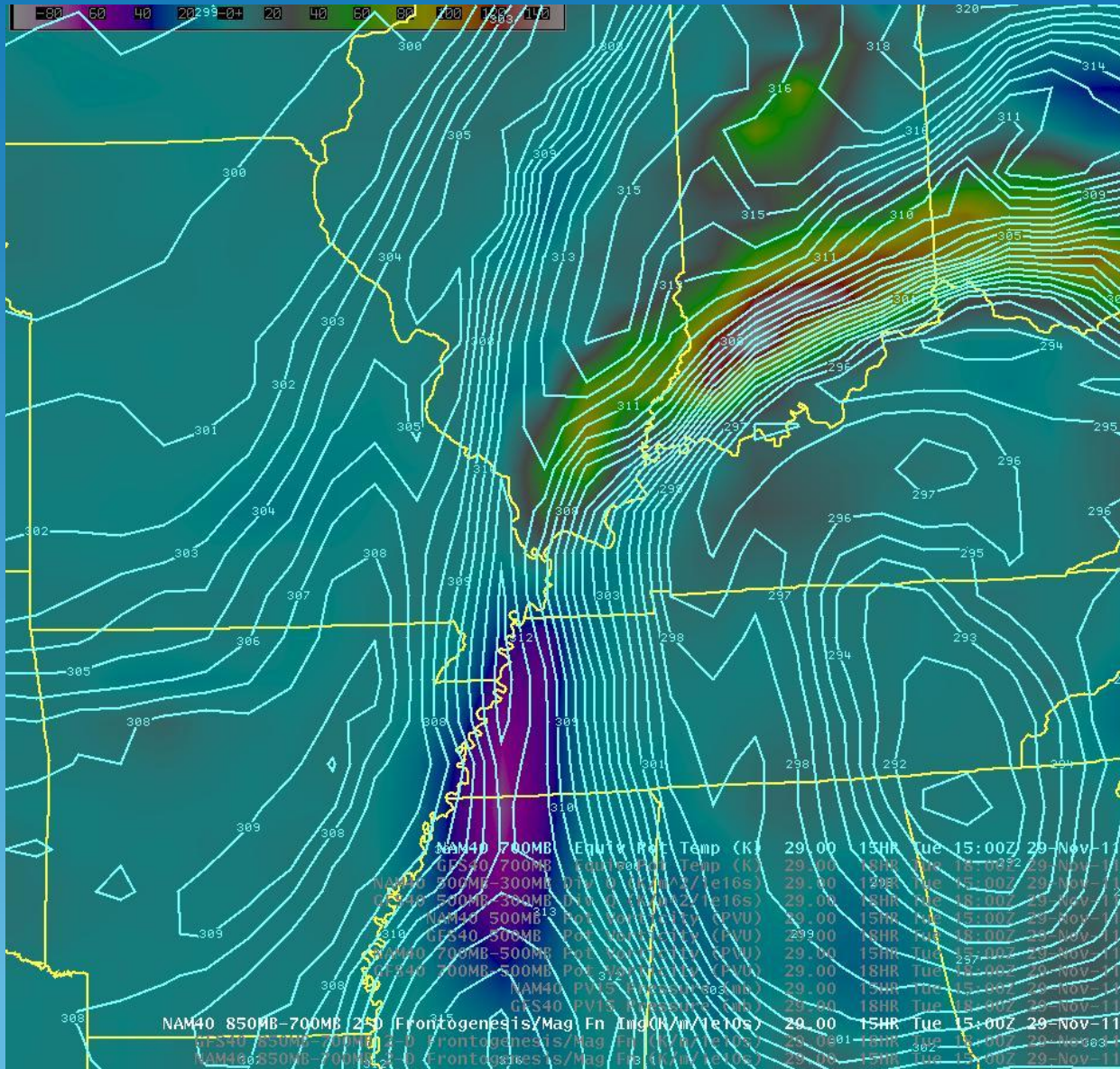
Frontogenesis and TROWAL – 09Z (3AM)



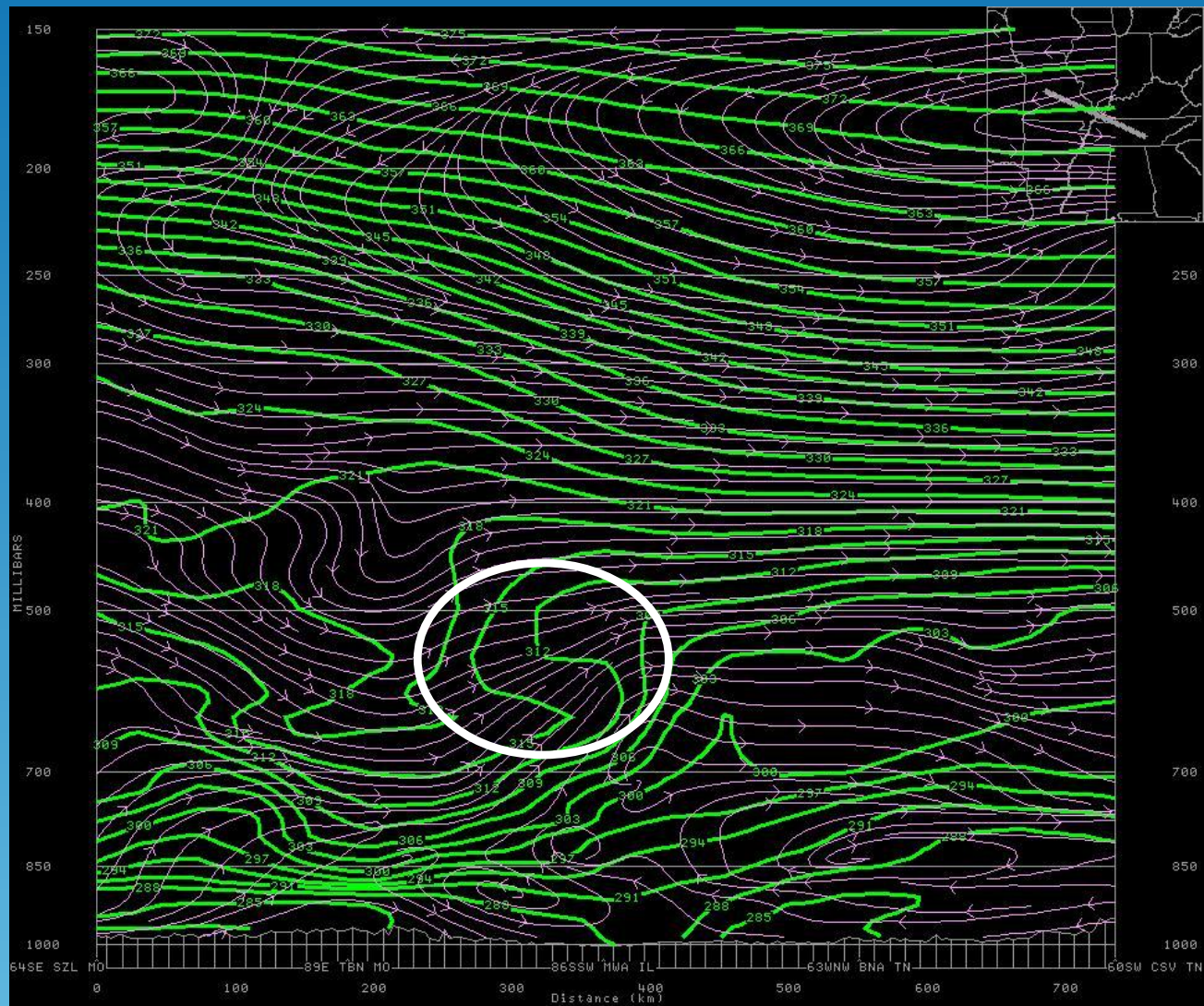
Frontogenesis and TROWAL – 12Z (6AM)



Frontogenesis and TROWAL – 15Z (9AM)

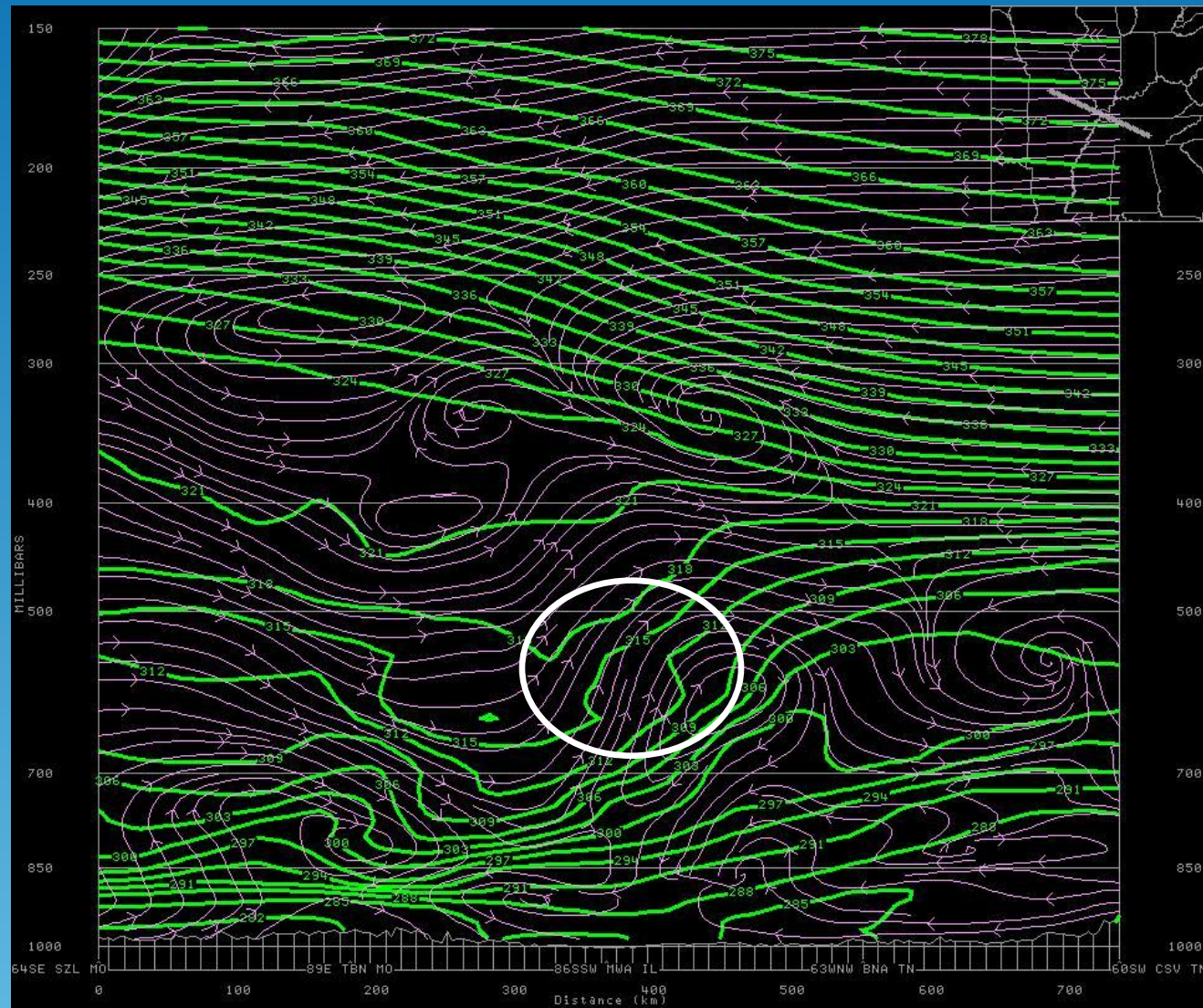


3-D TROWAL – 09Z (3AM)



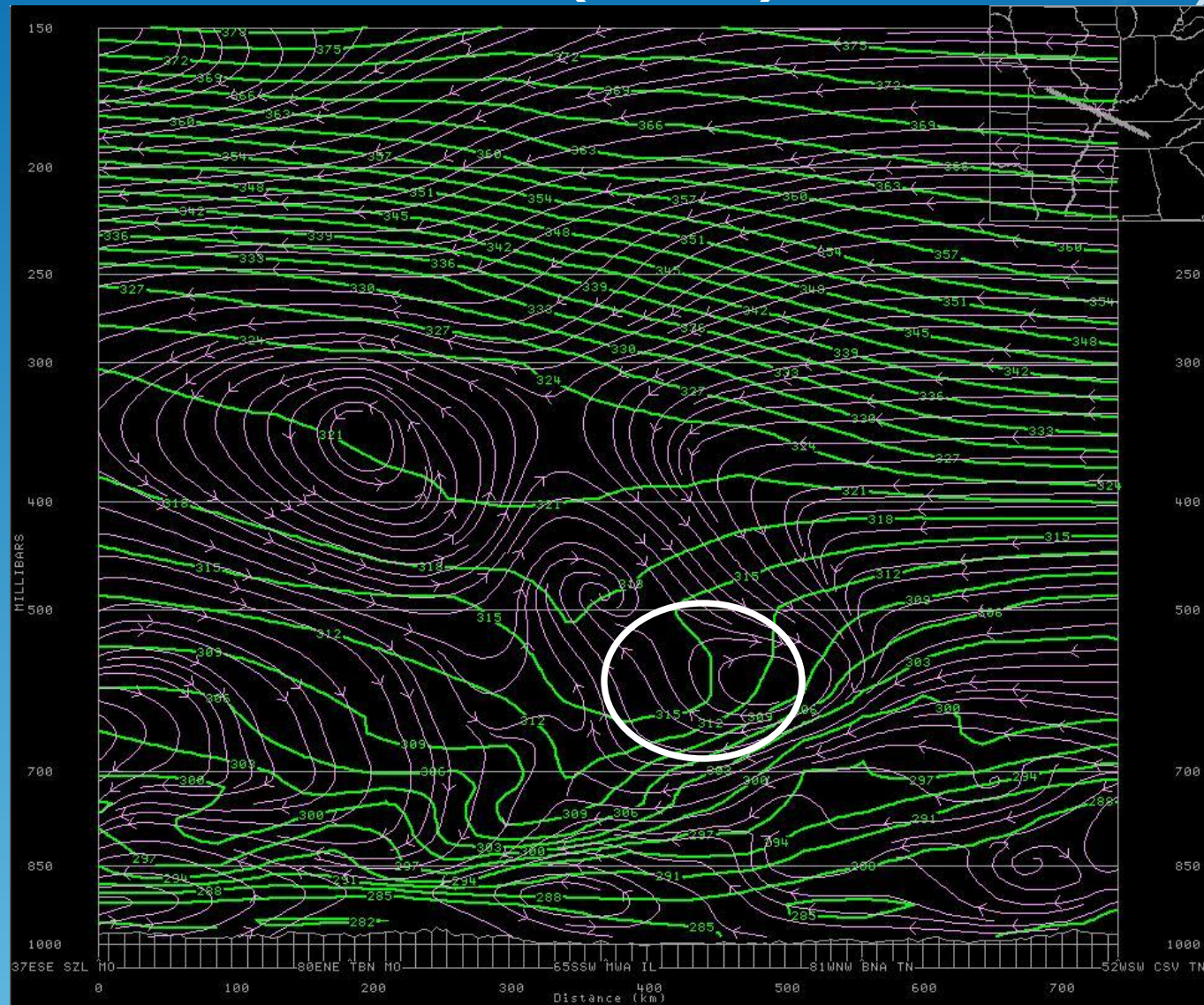
NAM lineA	Equiv Pot Temp	Img(K)	29.00	9HR	Tue 09:00Z	29-Nov-11
NAM40 lineA	Ageo Vert Circ	()	29.00	9HR	Tue 09:00Z	29-Nov-11
NAM lineA	Potential Temp	(K)	29.00	9HR	Tue 09:00Z	29-Nov-11
NAM lineA	Equiv Pot Temp	(K)	29.00	9HR	Tue 09:00Z	29-Nov-11

TROWAL - 12Z (6AM)



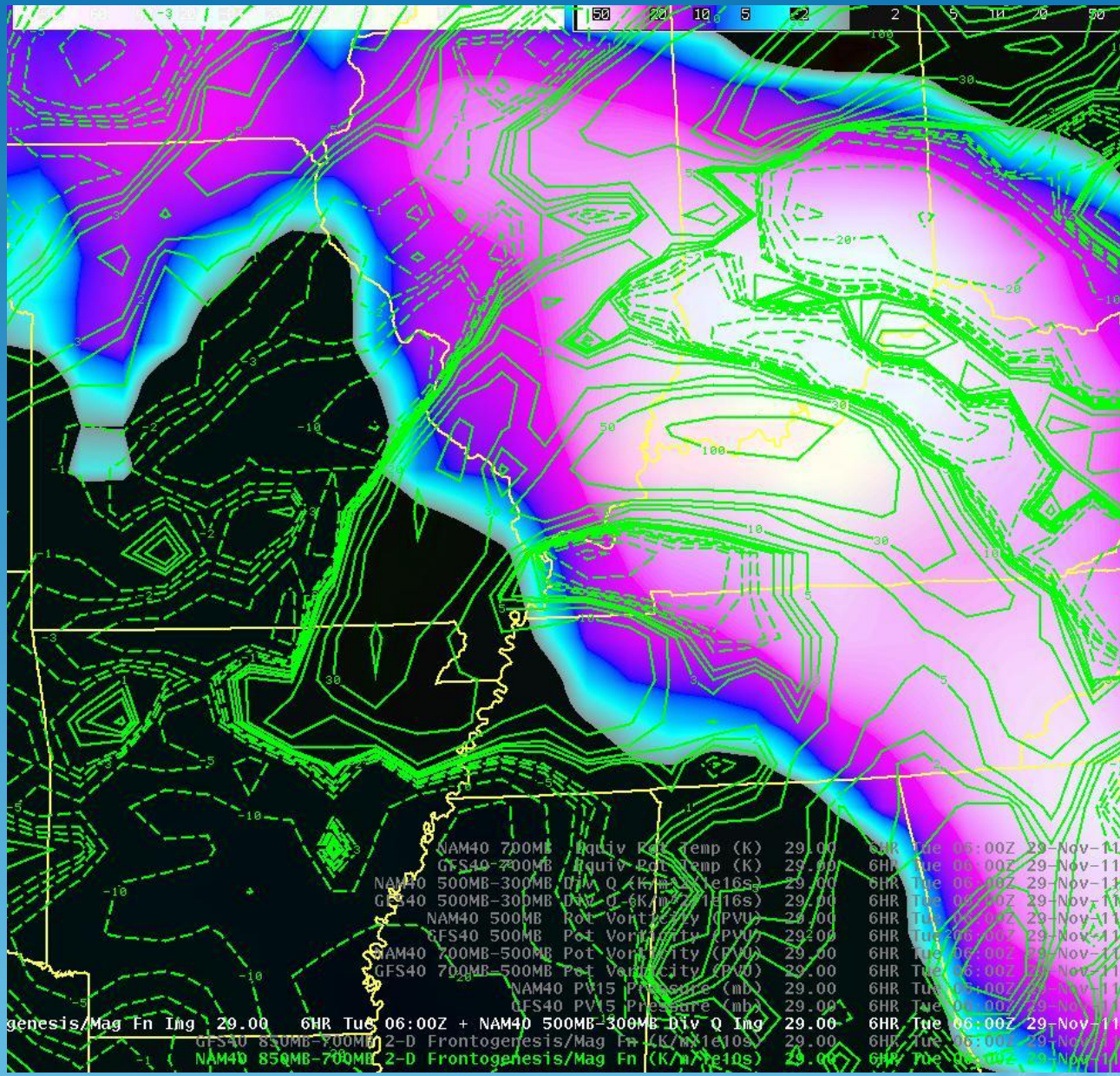
NAM lineA	Equiv Pot Temp	Img(K)	29.00	12HR	Tue	12:00Z	29-Nov-11
NAM40 lineA	Ageo Vert Circ	()	29.00	12HR	Tue	12:00Z	29-Nov-11
NAM lineA	Potential Temp	(K)	29.00	12HR	Tue	12:00Z	29-Nov-11
NAM lineA	Equiv Pot Temp	(K)	29.00	12HR	Tue	12:00Z	29-Nov-11

TROWAL – 15Z (9AM)

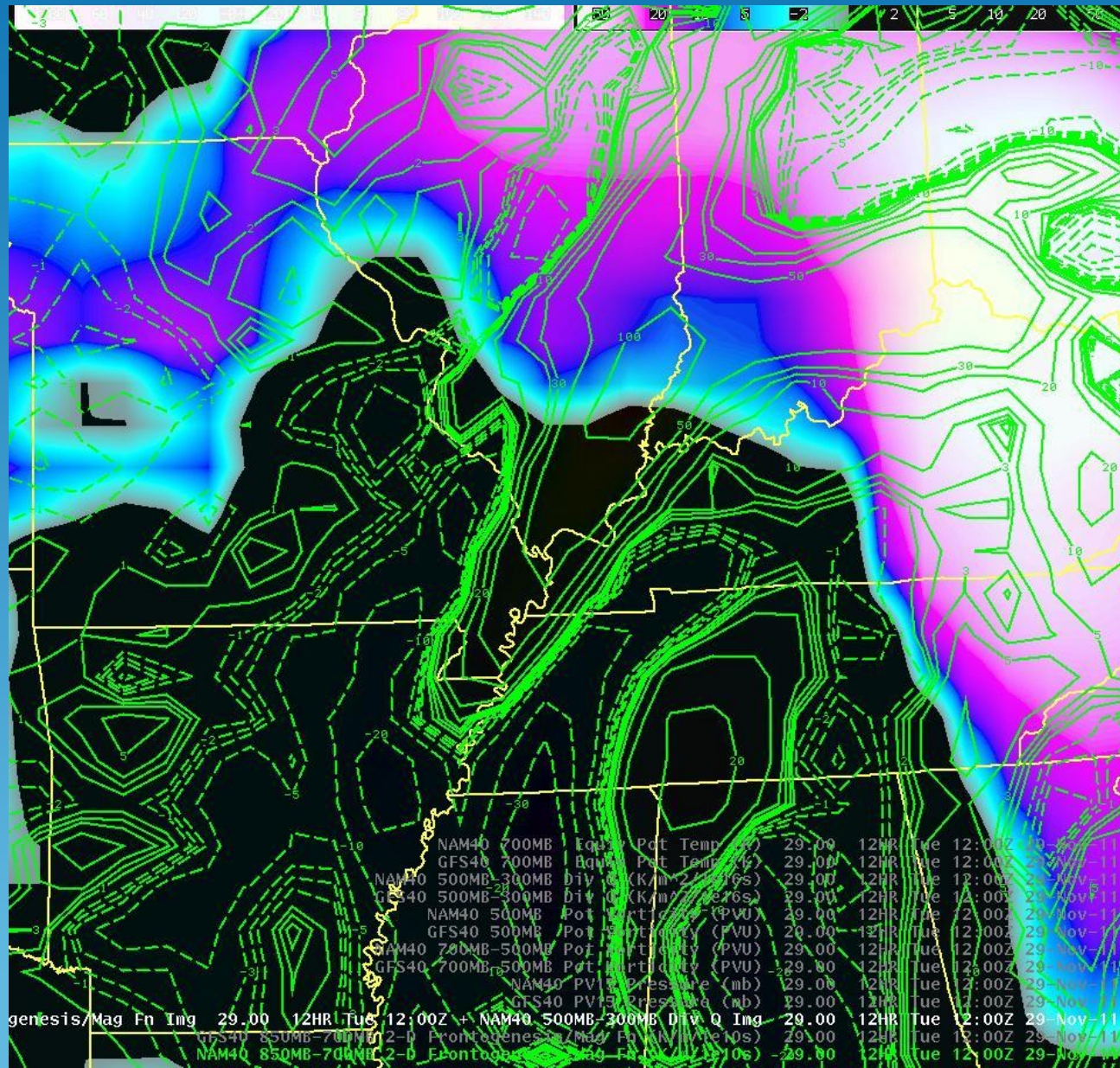


NAM40 lineA Ageo Vert Circ () 29.00 15HR Tue 15:00Z 29-Nov-11
NAM lineA Equiv Pot Temp (K) 29.00 15HR Tue 15:00Z 29-Nov-11

Frontogenesis and Div Q – 09Z (3AM)



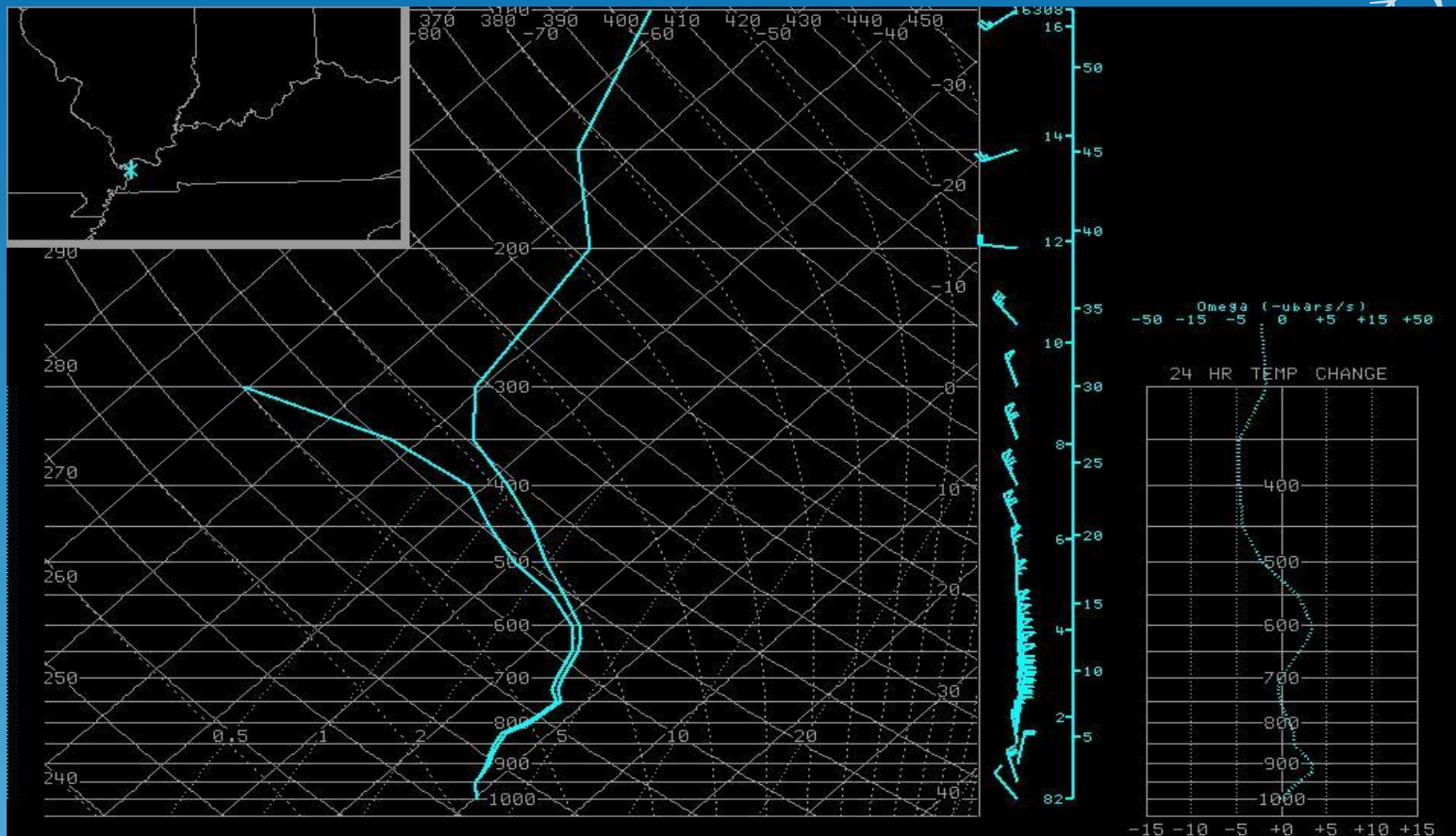
Frontogenesis and DIV Q – 12Z (6AM)







More Soundings - KY

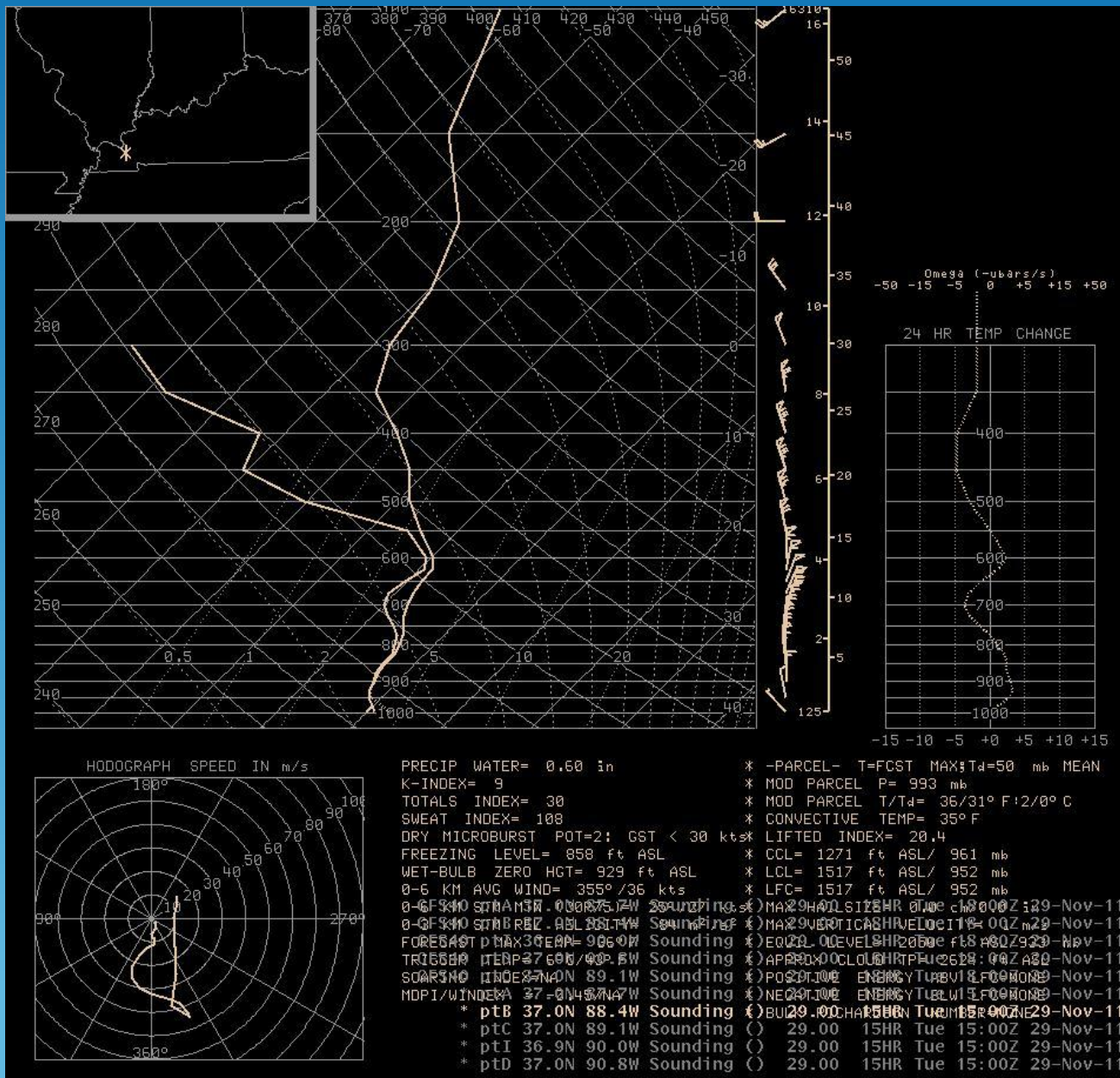


PRECIP WATER= 0.70 in
 K-INDEX= 10
 TOTALS INDEX= 28
 SWEAT INDEX= 96
 DRY MICROBURST POT=2: GST < 30 kts
 FREEZING LEVEL= 546 ft ASL
 WET-BULB ZERO HGT= 821 ft ASL
 0-6 KM AVG WIND= 357°/42 kts
 0-6 KM SPAN 35.000000 W Sounding
 0-6 KM STAB 82.000000 W Sounding
 FORECAST MAX 36.000000 W Sounding
 TRUSS 17.000000 W Sounding
 SOARING INDEX 89.1W Sounding
 MOPI/WIND 37.0N 88.4W Sounding
 * ptb 37.0N 88.4W Sounding
 * ptc 37.0N 89.1W Sounding
 * pti 36.9N 90.0W Sounding
 * ptd 37.0N 90.8W Sounding

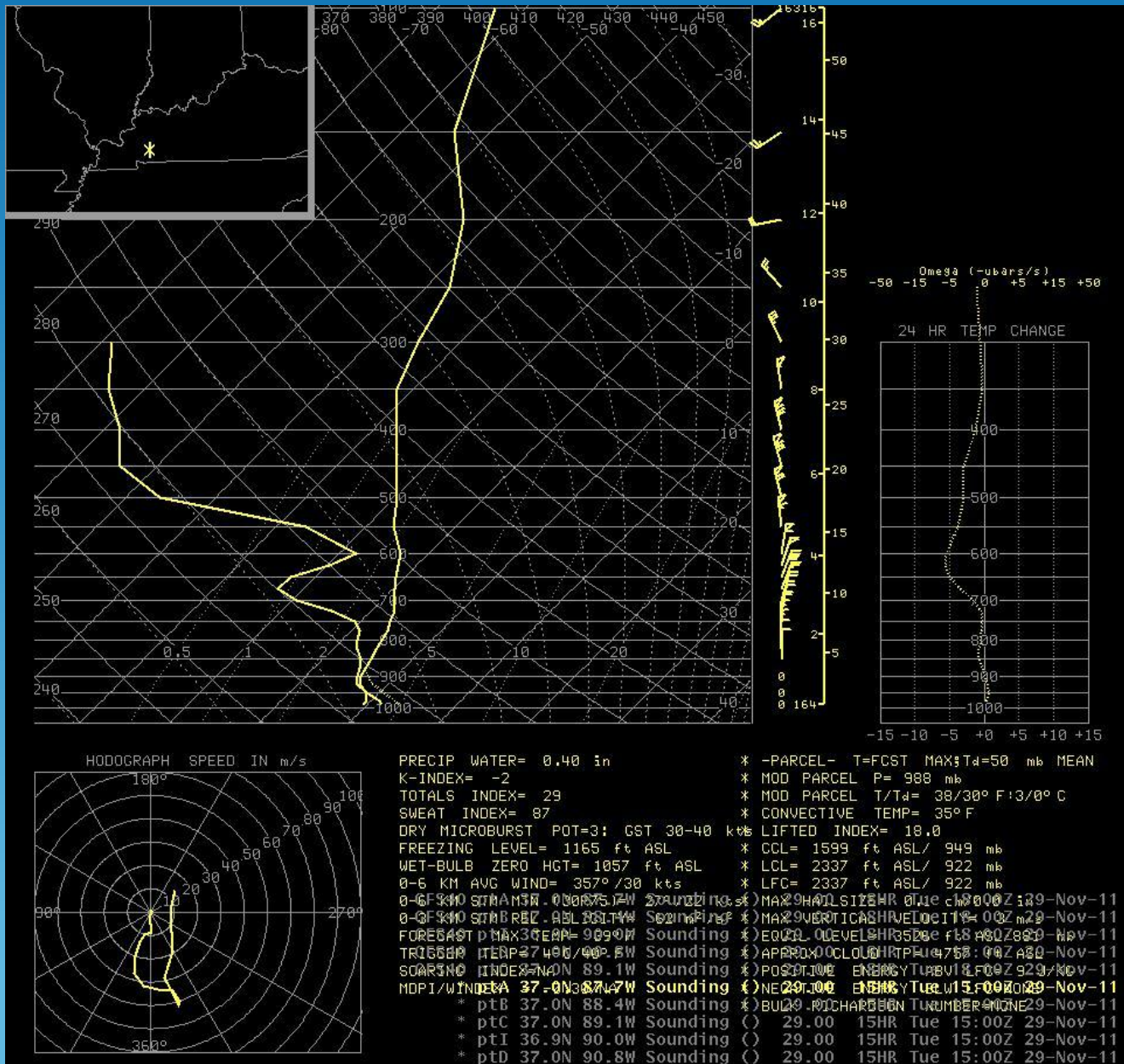
* -PARCEL- T=FCST MAX Td=50 mb MEAN
 * MOD PARCEL P= 1000 mb
 * MOD PARCEL T/Td= 32/-2147483648° F:0/
 * CONVECTIVE TEMP= 33° F
 * LIFTED INDEX= 999999993381501251071150
 * CCL= 269 ft ASL/ 1000 mb
 * LCL= 53395 ft ASL/ 100 mb
 LFC=NA
 0-6 KM SPAN 35.000000 W Sounding
 0-6 KM STAB 82.000000 W Sounding
 FORECAST MAX 36.000000 W Sounding
 TRUSS 17.000000 W Sounding
 SOARING INDEX 89.1W Sounding
 MOPI/WIND 37.0N 88.4W Sounding
 * ptb 37.0N 88.4W Sounding
 * ptc 37.0N 89.1W Sounding
 * pti 36.9N 90.0W Sounding
 * ptd 37.0N 90.8W Sounding

APPROX. CLOUD STOP= Tue 18:00Z 29-Nov-11
 POSITIVE EOCENER BLW LFC= Tue 15:00Z 29-Nov-11
 NEGATIVE EOCENER BLW LFC= Tue 15:00Z 29-Nov-11
 BULK 20.000000 W Sounding
 0-6 KM SPAN 35.000000 W Sounding
 0-6 KM STAB 82.000000 W Sounding
 FORECAST MAX 36.000000 W Sounding
 TRUSS 17.000000 W Sounding
 SOARING INDEX 89.1W Sounding
 MOPI/WIND 37.0N 88.4W Sounding
 * ptb 37.0N 88.4W Sounding
 * ptc 37.0N 89.1W Sounding
 * pti 36.9N 90.0W Sounding
 * ptd 37.0N 90.8W Sounding

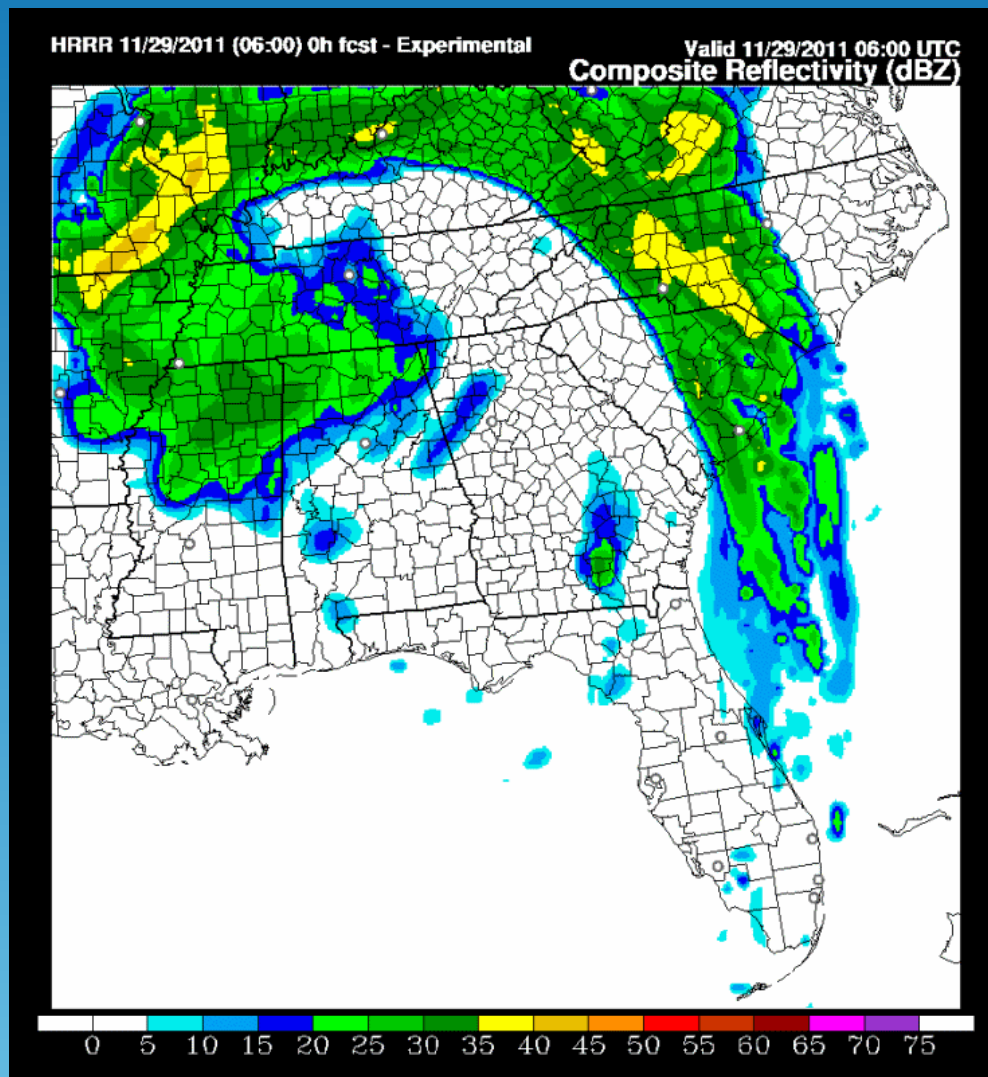
More Soundings - KY



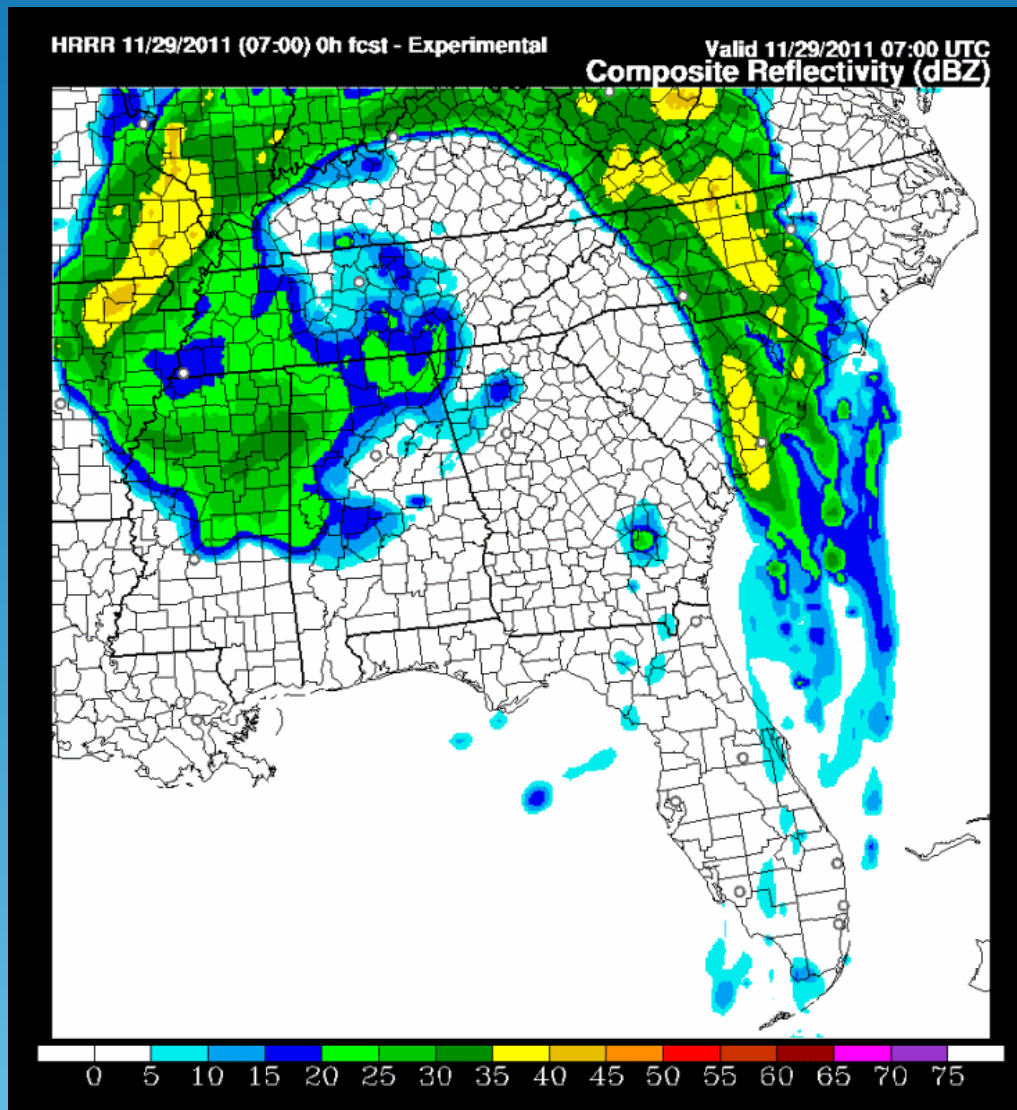
More Soundings near HOP



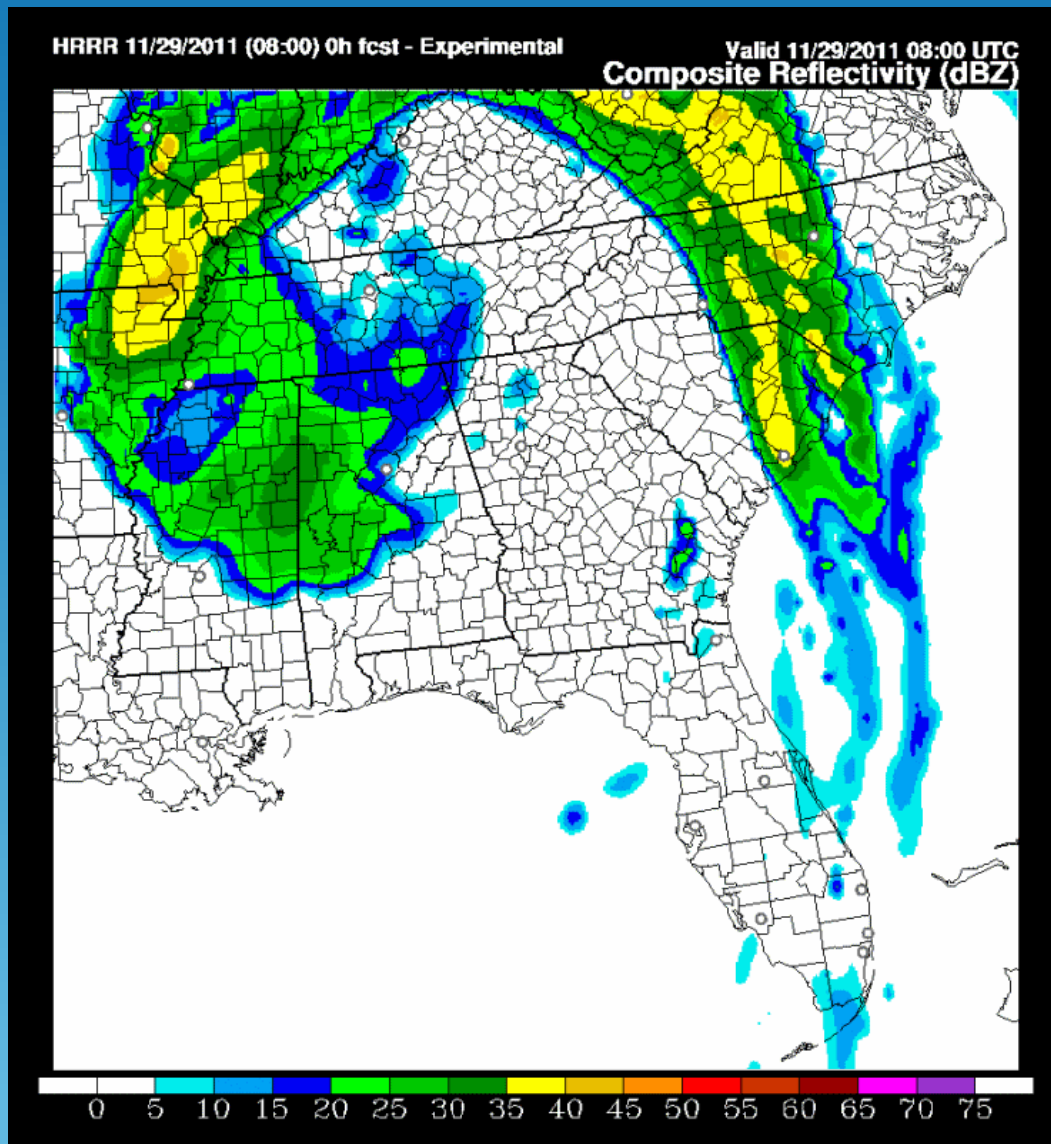
HRRR – 06Z Run - Loop



HRRR – 07Z Run - Loop



HRRR – 08Z - Loop



Other Thoughts

- Thundersnow is a rare event and even more difficult to forecast.
- However, whenever thundersnow occurs you can expect snowfall rates of 1-5 inches per hour. The 5 inches is an extreme event with the Chicago Blizzard of 2010. More than likely 2-3 inches per hour would be the norm.
- With that snowfall rate, it really does not matter what the temperature of the roads/ground are. The snow will be coming down too fast for melting to occur.
- Diabatic cooling likely played a role in this case. This is where intense rainfall quickly cools the column to sub-freezing.



Conclusion

- Hopefully, this training will add to the information provided at the 2011 Winter Weather Workshop.
- Again, we cannot forecast the exact location of where these heavy bands develop, although some of the mesoscale models like the HRRR do pretty well (they did well in this event), especially if successive runs point toward the same solution.
- This training is meant to give you an idea that banding is possible and may give you a general idea where.
- Watch the radar for higher dBZ's, these are not always indicative of the melting layer. Call around and ask about heavy snow, especially if they are lining up into bands over areas favorable for banded snowfall.
- Create procedures with 700-850 mb frontogenesis, 400-500 mb EPV, and 300-500 mb DIV Q. A 3-D location of the TROWAL would also be handy.
- These features should be part of every briefing when snow is in the forecast.